

# Interim Staff Analysis Formaldehyde and FEMA Trailers July 2008

**This is an interim staff analysis detailing the issue of formaldehyde in FEMA trailers, and the role of the manufacturers. Because this issue is ongoing and staff continues to obtain data, the issues discussed in the analysis remain open and subject to change.**

## **I - Executive Summary**

On July 9, 2008, the House Committee on Oversight and Government Reform will hold a hearing to further explore the issue of levels of formaldehyde reportedly emanating from travel trailers issued by the Federal Emergency Management Agency (FEMA) after Hurricanes Katrina and Rita hit the Gulf Coast in 2005. FEMA distributed these trailers for use as temporary housing for those displaced as a result of the storms.

This interim report evaluates the issue of formaldehyde and the trailer manufacturers who supplied units to FEMA after the 2005 hurricanes. It discusses the reasons the results of EPA and CDC studies are not without controversy. It shows that agencies had widely varying and inconsistent concerns about formaldehyde and discusses the absence of federal standards regulating formaldehyde in indoor air. It is important to note, however, that this report does not address the possible health effects associated with elevated or prolonged exposure to formaldehyde. These are also the subject of disagreement among government agencies and scientific studies and recommended exposure limits vary widely.

In the absence of government standards, blaming trailer manufacturers for doing what was expected of them would be misplaced and ineffective. In the 109th Congress, The Select Bipartisan Committee to Investigate the Preparation for and Response to Hurricane Katrina reported the failure of government, at all levels, to prepare and respond to a disaster that devastated people and property. The formaldehyde issue may demonstrate a continued government failure in some respects. For twenty-four years, HUD has set formaldehyde product standard and indoor air target levels for manufactured housing. Yet, these are now being criticized by other federal agencies as being too high, although these same agencies cannot agree on an alternative "safe" and reasonable standard. FEMA has compounded the problem. They reacted hastily by setting procurement requirements which effectively prevent travel trailers from being used for housing after future disasters. Serious oversight and reform efforts should resolve these various difficulties in a way which protects public health, clarifies vague government standards and does not penalize manufacturers and their tens of thousands of hard working employees.

The forthcoming hearing will examine the knowledge and role of trailer manufacturers in the formaldehyde issue. Although fourteen companies supplied trailers to the government as part of hurricane recovery efforts, only four firms were invited to testify: Gulf Stream Coach, Keystone, Forest River and Pilgrim International. According to the Committee's majority staff, these four were chosen because their units were identified by a study conducted by the Centers for Disease Control and FEMA in 2007-2008 as yielding the "highest" levels of formaldehyde.

Hurricanes Katrina and Rita resulted in massive population displacement along the Gulf Coast. Although many people chose to permanently leave the area after the storms, many others wanted to remain and rebuild their homes and lives. FEMA needed to find a housing solution that would satisfy the many needs of the displaced people. Tents were one possibility, but were obviously inadequate for long term occupancy. Docked cruise ships were also considered. Ultimately, FEMA decided to rely primarily upon travel trailers, because they provided a measure of permanence on a family's property and had basic utility capabilities.

FEMA has used such travel trailers for shelters in the aftermath of major disasters since Hurricane Andrew in 1992. Because it anticipated doing so again, FEMA proactively issued specifications for disaster response trailers in 2004. Nonetheless, the severity of the damage wrought by the 2005 hurricanes presented a challenge of a new magnitude. FEMA needed far more trailers than could possibly be bought from retail establishments. Therefore, in addition to buying trailers from dealers, FEMA directly engaged many companies and brokers to have trailers manufactured.

Trailer manufacturers responded to FEMA's needs in an unprecedented manner. For example, just days after Hurricane Katrina hit the Gulf Coast one manufacturer, Gulf Stream, was awarded a competitively bid contract for 25,000 trailers. One week later Gulf Stream was awarded another contract for 25,000 additional units, bringing their total order to 50,000. Fifty thousand trailers to be produced by one manufacturer in a relatively compressed amount of time was an unprecedented requirement for the company and the industry. In fact, because of the enormity of the disaster and the magnitude of the need, Gulf Stream expanded its planned output of trailers from 80 per day to 300 per day.<sup>1</sup> Indeed, FEMA hoped Gulf Stream would increase production to a rate of 800 trailers a day. The manufacturer, however, pointed out this was an impossible goal for the entire industry, and certainly not one which could be achieved by a single firm.<sup>2</sup>

Despite being pushed to new limits, the industry responded to FEMA's need for disaster housing by providing 120,000 travel trailers in nine months. In the same period, 25,000 park models (larger and more permanent units) and other types of manufactured homes were also supplied.

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<sup>1</sup> In late August 2005 and early September 2005, Gulf Stream wrote letters to FEMA proposing production levels which started at 80 and then grew to 120. Gulf Stream and FEMA finally settled on a monthly schedule which had production levels averaging 300 trailers per day.

<sup>2</sup> Manufacturer supplied documents – e-mail

In the Spring of 2006, FEMA fielded a small number of calls from trailer occupants who complained about odors in their FEMA-supplied trailers. In roughly the same time period, the Sierra Club began testing some of the FEMA trailers because of specific complaints about formaldehyde. The results of the tests were released in May 2006 to considerable media fanfare. In sum, the Sierra Club believed its evaluation showed what it considered to be high levels of formaldehyde. As would be expected, with the Sierra Club findings and subsequent media attention came additional occupant complaints and the first class-action lawsuit.

In the summer of 2006, with the formaldehyde issue growing, FEMA reacted. The Agency engaged the U.S. Environmental Protection Agency (EPA) and the Centers for Disease Control (CDC) to assist in testing the level of formaldehyde gas in FEMA trailers. The tests were conducted in two stages. First, in September and October 2006, EPA tested 96 unoccupied trailers. The trailers tested were previously closed up in storage awaiting distribution. In November and December 2007, the CDC tested 519 occupied trailers. These tests were conducted in everyday use conditions. Both occupied and unoccupied trailers were evaluated to determine if the operational conditions affected the test data. The results of the EPA tests were made public in February 2007.<sup>3</sup> The CDC study of occupied trailers was published as an interim report in February 2008 and made final on July 2, 2008.<sup>4</sup>

Significant questions surrounding the tests subsequently arose. Importantly however, even assuming the CDC report was flawless; the results showed that the vast majority of trailers tested well within target formaldehyde guidelines set by the Department of Housing and Urban Development (HUD) for indoor ambient air. In fact, the arithmetic mean for the trailers in question tested nearly five times below the HUD-suggested guideline.<sup>5</sup>

For formaldehyde, HUD set a target of 400 parts per billion (ppb) for indoor ambient air in manufactured homes. HUD's indoor ambient air target guideline of 400 ppb is based on component standards for plywood (200 ppb) and particleboard (300 ppb). In the unoccupied units, testing revealed baseline formaldehyde levels were 1040 ppb but fell to an average of 390 ppb when the air conditioner was on. The averages fell even lower, to 90 ppb, when windows were opened. The baseline average is probably attributable to the fact the unoccupied trailers were sealed up in storage; they were in the sun and had little to no air entering or exiting. In all occupied units the average level was 77 ppb, and 81 ppb for travel trailers specifically.

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<sup>3</sup> Agency for Toxic Substances and Disease Registry, US Department of Health and Human Services. Formaldehyde, Sampling of FEMA Temporary-Housing Trailers, February 2007. In October 2007 the report was updated to include a health consultation.

<sup>4</sup> Centers for Disease Control and Prevention, US Department of Health and Human Services, Final Report on Air Quality in FEMA Supplied Mobile Trailers, July 2, 2008.

<sup>5</sup> In the occupied units, the formaldehyde results showed an arithmetic mean for travel trailers of 81 ppb, with a 95% confidence interval for the mean being between 72-91 ppb.

## **II- Brief History of Hurricane Katrina and Rita**

### *Magnitude and Scope of the Effects*

Hurricanes Rita and Katrina were the fourth and sixth most intense tropical cyclones ever recorded in the Atlantic. Each was designated the maximum category 5 classification at some point, although both made landfall as category 3 storms. While there have been more powerful storms, these hurricanes were particularly potent because they hit a vulnerable swath of the northern coast of the Gulf of Mexico, including Texas, Louisiana, and Mississippi. Louisiana was particularly vulnerable because of its geography and the fact it had long allowed habitation in areas, such as in New Orleans, which are below sea level. Due to the unique combination of these circumstances and “a failure of initiative” by all levels of government, these hurricanes caused several times the damage of any previous storm.<sup>6</sup>

### *Numbers of Displaced Families*

Katrina and Rita resulted in a massive population displacement. Over one million Gulf Coast residents were forced to leave their homes, at least temporarily, as a result of the storms. In the immediate aftermath, the Red Cross registered record numbers of overnight stays in its shelters. In some cases usage was seven times the number recorded in the 2004 hurricane season. Tens of thousands of people fled to neighboring areas. Hundreds of thousands of others remained on the Gulf Coast with no long term shelter.

## **III – Role of FEMA in Meeting Housing Needs**

Many people left the Gulf Coast region never to return. They resettled in other areas, sometimes with the assistance of FEMA. Nevertheless, a significant number opted to stay in the Gulf Coast region and reconstruct their lives to the best of their ability. Some of these people had friends or relatives with habitable houses; others had nowhere to go. At first, shelters, such as those run by the Red Cross, met the need. However, these were often located in schools or similar facilities, and therefore could be used only temporarily. Additionally, many people wanted to return to their land, even if the structures built there had been destroyed or damaged.

Consequently, FEMA sought a housing solution which satisfied these conditions. Tents were one possibility, but they were inadequate for long term inhabitation. Docked cruise ships were also considered. Ultimately, FEMA decided to rely primarily upon travel trailers. Such units provided a measure of permanence and can be hooked up to provide basic utility capabilities. A smaller number of other types of units termed “park models” and “manufactured homes” were also purchased.

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<sup>6</sup> Report of the The Select Bipartisan Committee to Investigate the Preparation for and Response to Hurricane Katrina, February 2006

FEMA had used travel trailers for emergency shelter since Hurricane Andrew in 1992. The Agency was so certain it would do so again that in 2004, it proactively issued specifications for the procurement of additional disaster response trailers. Nonetheless, the severity of the damage wrought by Hurricanes Katrina and Rita presented a challenge of a new magnitude. FEMA needed many more trailers than could possibly be bought from retail establishments. Therefore, in addition to buying trailers from dealers, FEMA engaged many manufacturers directly or through brokers. In the end, FEMA procured 120,032 travel trailers and 25,767 other types.<sup>7</sup>

#### IV - FEMA Trailer Testing

##### *Formaldehyde Background*

Formaldehyde is a naturally occurring substance used in a wide variety of applications. It is among the 25 most-produced chemicals in the world and is sometimes present in substantial concentrations indoors and outdoors. Formaldehyde is frequently an ingredient of the glues used to make particle board and plywood. Travel trailers contain walls, cabinetry, and various other components made of these materials. Over time, a small amount of the formaldehyde in these components escapes in the form of gas into the surrounding area. Formaldehyde levels can be increased by heat and humidity. Closing or storing trailers can also allow the gas concentration to increase because, without ventilation, the formaldehyde cannot dissipate. Over time, the amount of formaldehyde off-gassing decreases. The chemical has a four to five year half-life.<sup>8</sup>

Only two federal agencies, Department of Housing and Urban Development (HUD) and the Occupational Safety and Health Administration (OSHA), regulate the use of formaldehyde. Since 1984, HUD has limited the formaldehyde emissions of plywood (to 200 parts per billion) and particle board (300 ppb) used in the construction of “manufactured housing.” HUD also suggests that formaldehyde be limited to 400 ppb or less in the indoor ambient air of such units.<sup>9</sup> OSHA regulates formaldehyde exposure in the workplace. The Agency has two separate standards. One, for an average workday (750 ppb) and a second for 15 minute short term exposure (2,000 ppb).<sup>10</sup>

It is important to note travel trailers are not subject to these or any other federal formaldehyde regulations. Nonetheless, the travel trailer industry has voluntarily accepted the HUD guidelines for its products and the plywood and particle board used in

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<sup>7</sup> FEMA supplied charts on contracts quantities and numbers.

<sup>8</sup> October 2007 Update on February 2007 report: Formaldehyde Sampling of FEMA Temporary-Housing Trailers, Agency for Toxic Substances and Disease Registry, US Department of Health and Human Services, Page 8. The ambient concentration of formaldehyde can differ depending on three conditions: the volume of air, the amount of formaldehyde and the extent of ventilation. In other words, the effect of any amount of formaldehyde depends on the volume of the space and the amount of fresh air being circulated. The larger the area and the more fresh air, the less that formaldehyde is a problem.

<sup>9</sup> Formaldehyde Emissions Controls for Certain Wood Products, Manufactured Home Construction and Safety Standards, US Dept. of Housing and Urban Affairs, 24 C.F.R., 3280.308, 49 Federal Register 31996

<sup>10</sup> <http://www.osha.gov/SLTC/formaldehyde/>

their manufacture. This is a logical step because some trailer firms build manufactured homes too. Since manufactured homes and trailers have some common characteristics and share the same suppliers, in the absence of direct federal regulation, accepting a single standard standardizes their process. More importantly, from a public health standpoint, adoption of a formaldehyde standard and ambient air target level intended for similarly constructed housing that is intended for long term occupancy would provide an extra measure of safety for trailers not generally used for permanent residence.

### *The Controversy*

The controversy involving formaldehyde in FEMA trailers began in 2006 when the Sierra Club released a report saying it had found elevated levels of formaldehyde in some of these units. The impetus for the Sierra Club testing was apparently complaints the organization received from some trailer occupants about poor indoor air quality believed to be causing problems such as burning eyes, throat irritation, headaches, and bloody noses.<sup>11</sup> The Sierra Club conducted its formaldehyde testing in April 2006. On May 16, 2006 the Sierra Club announced it had found what it said were elevated formaldehyde concentrations in 30 of the 32 trailers tested.<sup>12</sup> The findings ranged from 60 ppb to 340 ppb.

The tests on the FEMA trailers were done at the Club's own initiative. Details about the means and methods used in the testing were not available to the Committee minority staff. Therefore the scientific validity is unknown. But even accepting the Sierra Club's results at face value, it is important to note that they are within the HUD target guidelines for indoor ambient air in manufactured housing.

Since releasing the data and conducting additional tests in 2007, the Sierra Club has initiated an effort to have the Environmental Protection Agency adopt nationwide formaldehyde standards for wood emissions similar to those of the California Air Safety Board (CARB), which will tighten the formaldehyde emissions from wood composites at 90 ppb for particleboard and 110 ppb for medium density fiberboard.<sup>13</sup>

Because of the heightened awareness of formaldehyde and in order to meet the need for impartial data, in July 2006 FEMA asked the Agency for Toxic Substances and Disease Registry (ATSDR) to evaluate air quality samples collected by the Environmental Protection Agency (EPA) from 96 unoccupied trailers stored (without ventilation) in Baton Rouge, Louisiana. The ATSDR tests were conducted between September and October in 2006. The Agency found formaldehyde at an average level of 1,040 parts per billion. ATSDR also found that operating the air conditioning and opening windows reduced formaldehyde levels significantly, to 390 ppb and 90 ppb

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<sup>11</sup> AP article forwarded as email, GS 00297

<sup>12</sup> Ibid

<sup>13</sup> California Air Resources Board, the regulation is a proposed rule and is expected to be finalized this Summer. The rule requires wood emissions in two phases, starting January 1, 2009 particleboard emissions are limited 180 ppb, and medium density fiberboard to 210 ppb. In 2011 the standards would lower to 90 ppb for particleboard and 110 ppb for mdf. The Recreational Vehicle Industry Association members have voluntarily accepted to comply with the CARB standards nationwide.

respectively. Any formaldehyde off-gassing which might normally have occurred as units sat unoccupied was nearly impossible in these cases because FEMA had essentially “shrink-wrapped” these unused trailers and left them in the sun. It seems that in doing so, FEMA may have unknowingly caused the formaldehyde in the trailers to become especially concentrated.

The ATSDR study also found that there was a correlation between temperature and formaldehyde levels. This is especially relevant because lower temperature and humidity is a commonly accepted method, combined with proper ventilation, to rid small confined areas (such as trailer interiors) of formaldehyde concentrations. In addition, the ATSDR declared, “the exposure scenarios examined by the sampling were not intended to represent those that people living in the trailers would experience.”<sup>14</sup>

After the ATSDR results were known, FEMA asked the Centers for Disease Control (CDC) to study the air quality of occupied units. The study was performed in December 2007 and January 2008. The study of 519 units covered all temporary housing types, including 358 travel trailers. The mean formaldehyde result for travel trailers was 81 ppb, with a 95% confidence interval for the mean being between 72-91 ppb. Of all the occupied units of all types tested, only six had formaldehyde levels above HUD’s ambient air quality guidelines. Nonetheless, based on these findings the CDC recommended relocating all travel trailer occupants.

#### *Questions Surrounding the CDC Testing*

The process by which FEMA trailers were tested by the CDC was controversial. In several ways it seemed to depart from sound practices. Consequently, there are considerable questions about the validity of the tests.

#### *Levels considered “safe”*

The CDC report “suggests” that the levels of formaldehyde in trailers are “[e]levated” and “suggests” “[a]ctions should be taken to limit further exposure to residents.” Yet, the report specifies that the formaldehyde levels were “elevated” only in comparison to “[t]ypical US background levels.”<sup>15</sup> Although this may be factually correct, it is also misleading. Comparing formaldehyde levels in relatively new 300 square foot trailers, made primarily for temporary housing, to traditional housing, provides a distorted impression. In addition, the typical background levels used for comparison in this study were derived from a study that tested average levels of formaldehyde in site-built homes in Los Angeles, Houston, and Elizabeth, New Jersey.<sup>16</sup> Site-built houses in these regions are likely to be older and larger than trailers and the climate in which most are located has little in common with the Gulf Coast. In fact, another study conducted by Tulane University of homes in the Baton Rouge/ New

<sup>14</sup> “An Update and Revision of ATSDR’s February 2007 Health Consultation.” October 2007

<sup>15</sup> Although they do not cite how they arrived at their statistic, according to the CDC normal background levels for indoor air fall between 10-30 ppb.

<sup>16</sup> Health Effects Institute, *Relationship of Indoor, Outdoor and Personal Air* (RIOPA) 2005

Orleans area found new site-built homes there had significantly higher formaldehyde levels.<sup>17</sup> If this study had been used as a baseline by the CDC instead, the report may have reached different conclusions because it would have found that FEMA trailers had levels of formaldehyde *below* the baseline.

In fact, there is some evidence that prior to releasing their report on occupied trailers; CDC officials debated what level of formaldehyde should be considered safe. In January and February 2007, the agency seemed to agree that formaldehyde in concentrations below 300 ppb would be satisfactory.<sup>18</sup> Eventually, however, the CDC did not specify a “safe” number. The document conceded that “various exposure limits developed for formaldehyde are widely variable and none relate directly to occupied trailers.” This seems to indicate that the science on indoor formaldehyde levels is unsettled and varies from scientist to scientist.<sup>19</sup>

### *No Outside Measurements*

Another criticism of the occupied trailer tests was the fact that CDC did not measure the outdoor ambient air levels around the units. Some hypothesize that hurricane-hit areas have high residual levels of toxins that were brought in or stirred up by storms. If so, formaldehyde may have been seeping into trailers in the Gulf from outside.

The CDC has given conflicting answers as to why they did not measure the outdoor air. According to the manufacturers, CDC did not conduct outside measurements because FEMA did not request them. However, when Committee staff interviewed CDC officials by telephone, they stated they “wanted” to do so, but could not because of personnel and time constraints. Later, CDC indicated it believed such measurements would probably have indicated a negligible formaldehyde level. But, even if the results were “likely” to show low levels outside, it would have been valuable to have these test results, to eliminate any uncertainty about the CDC findings.

Even if one accepts, without question, the CDC assertion that the trailers had elevated levels of formaldehyde, it is necessary to acknowledge that 513 of the 519 units tested *below* the HUD target guidelines for indoor ambient air quality. In fact, the arithmetic mean for all the units combined was 77 ppb and for trailers it was 81 ppb. Both levels are five times less than the HUD target.

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<sup>17</sup> R. Lemus, A.A. Abdelghani, T.G. Akers and W.E. Homer, Potential Health Risks to Exposure to Indoor Formaldehyde, *Reviews on Environmental Health*, Vols 13 Nos 1-2, 1998, Pages 91-98.

<sup>18</sup> In e-mails supplied to the House Science Committee, <http://science.house.gov/publications> it is clear that as early as January 2007, the CDC staff had prepared an executive summary stating their findings of the average concentration of formaldehyde in the trailers were well below 300 ppb and this was well below the health concern for sensitive individuals. Moreover, ATSDR’s initial February 2007 Health Consultation for FEMA on formaldehyde in temporary housing trailers noted that 300 ppb represented a level of concern for formaldehyde exposure I sensitive individuals.

<sup>19</sup> Centers for Disease Control and Prevention, US Department of Health and Human Services, Interim Findings on Air Quality in FEMA Supplied Mobile Trailers, February 21, 2008, pg 15, footnote (6).



## *Methodology*

Finally, there is another troubling aspect to the CDC report: the methodology. The CDC study used varying scientific techniques to reach conclusions. The study's methodology called for the 519 units to be chosen by randomly sampling the entire stock of occupied FEMA trailers. In order to conduct the random sample, CDC relied on FEMA to supply a database matching manufacturers to specific trailers. Yet, there is ample anecdotal evidence to suggest this database was incomplete and inaccurate.<sup>20</sup> For example, several manufacturers told staff that during the normal course of activities, FEMA would often ask a manufacturer about a specific trailer, making reference to the Vehicle Identification Number (VIN). However, often the company would report back that the given VIN was not attributable to a unit made by the particular firm. This seems to suggest that manufacturer data provided by FEMA to the CDC was incomplete and possibly inaccurate. If this is true, then the CDC report relying on this data may have been flawed from the outset. FEMA has yet to provide a database to the minority staff. In fact, it may not even be possible to create such a database given the length of time which has transpired since delivery.

## *Other Issues*

Formaldehyde is exhaled in human breath and found in many common products. Levels of formaldehyde can be increased indoors by lighting a cigarette or starting a gas range. Cooking fish can also increase formaldehyde dramatically, to anywhere from 480 ppb to 5310 ppb. In addition, air fresheners can also emit formaldehyde. These points are significant because they illustrate the difficulties of accurately measuring in an occupied trailer the formaldehyde being emitted by the unit alone. If occupants have smoked, cooked fish on a gas range, or attempted to eliminate formaldehyde odors using air fresheners, they could increase the gas levels and complicate efforts to measure the amount produced by the trailer.

## *Hancock County Mississippi Study of Children Living in FEMA Trailers*

On April 24, 2008, the CDC also released a health study of children in Hancock County, Mississippi who were between two and twelve years old. The study's purpose was to determine if the upper respiratory health of children living in FEMA trailers differed from those who did not. **The results showed no discernable difference.** Although this study was hampered by the inability to examine medical records which were destroyed by the storms, and the results are only applicable to the county studied, it provides some relevant insights.

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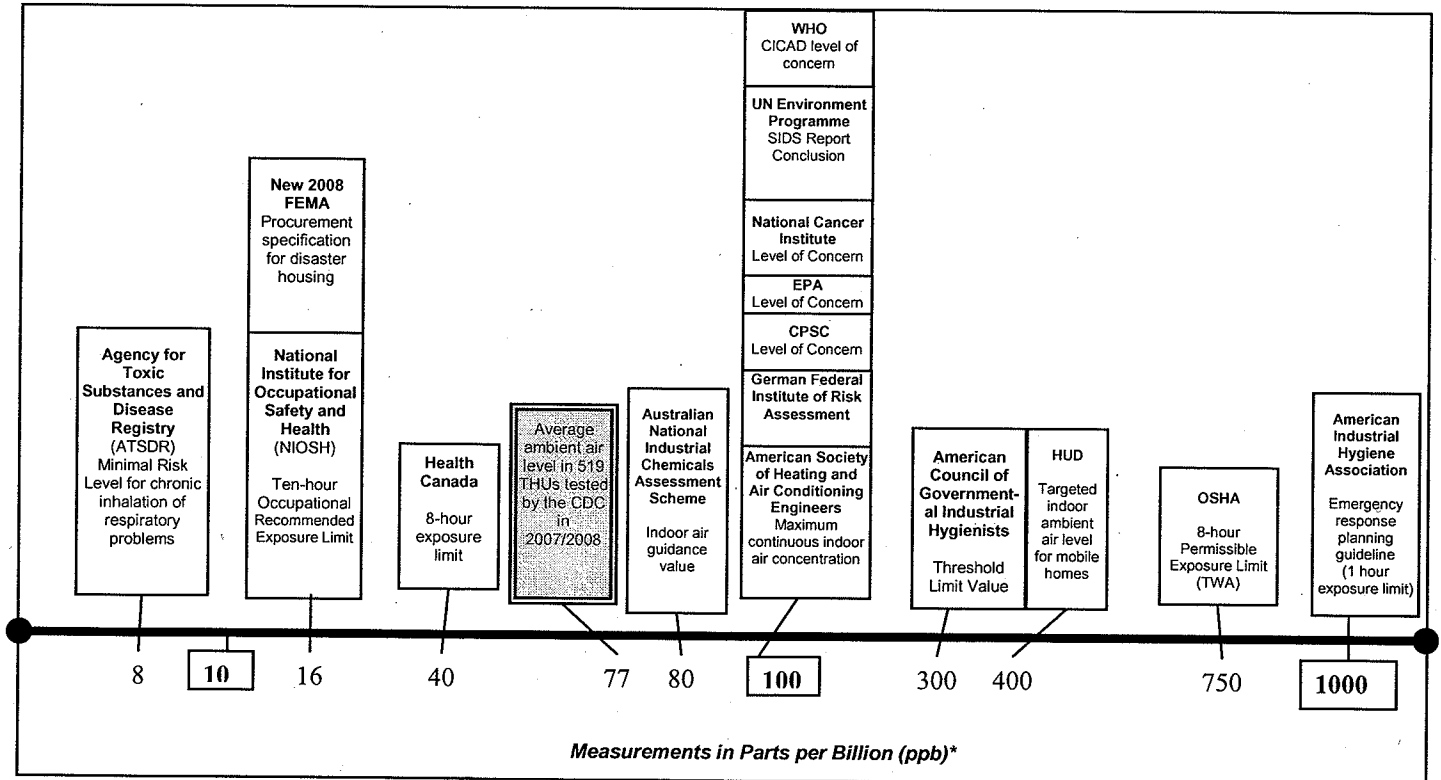
<sup>20</sup> Interviews with the industry and direct conversations with FEMA suggests FEMA has no easily accessible database matching trailer to manufacturer or worse a database that is incomplete or inaccurate.

## V - Varying Standards

A fundamental difficulty in assessing potential problems caused by formaldehyde is the lack of uniform regulatory standards. As has been discussed, only HUD and OSHA have legally mandated standards in the United States, and these are very different. HUD restricts formaldehyde emissions in plywood to 200 ppb and particle board to 300 ppb. OSHA restricts exposure during an average workday to 750 ppb with a 15 minute short term exposure level of 2,000 ppb. Other U.S. agencies have non-binding guidelines with various ranges, from the National Institute for Occupational Safety and Health's 16 ppb in ten hours, to HUD's 400 ppb in indoor ambient air in manufactured homes. The California Air Resource Board, a state regulatory entity, has established a another standard for that state (which is not yet in effect) which will require by 2014 that some formaldehyde-emitting materials emit as little as 50 ppb.

Nongovernmental organizations and foreign agencies also have a wide array of standards. The Canadian federal government sets an eight hour exposure limit at 40 ppb. The American Industrial Hygiene Association has 1,000 ppb for one hour as its emergency response planning guideline. An assortment of other organizations has recommendations between these extremes as shown in Chart A below. By comparison, the average level of formaldehyde detected in all types of temporary housing in CDC's occupied trailer study was 77 ppb. For travel trailers alone, this figure is 81 ppb.

Chart A



In light of the absence of any federally mandated formaldehyde standard for the travel trailer industry, it seems the most relevant existing standard is HUD's 400 ppb guideline, although this is intended for "manufactured houses" and is not legally binding on travel trailers. In the past, the acceptance of this standard seemed to be confirmed by the fact that manufacturers had never received any formaldehyde complaints from the trailers issued in previous years by FEMA. However, as a result of the problems reported in the Katrina and Rita housing, FEMA instituted a new standard in April 2008. Henceforth, all temporary housing of any sort procured after that time must emit 16 ppb or less of formaldehyde.

#### *HUD Guidelines/Standards*

The current HUD standards for manufactured homes were announced in 1984.<sup>21</sup> At the time, HUD "concluded that an indoor ambient air level of 400 ppb provides reasonable protection to manufactured home occupants."<sup>22</sup> The announcement also acknowledged there was "considerable disagreement" concerning this target level. The Department declared:

The currently available medical and scientific evidence does not adequately establish the effects on health benefits of a level below 400 ppb. [I]n any event, it is not possible to implement a formaldehyde standard that will protect the entire population.<sup>23</sup>

In May 2008, HUD announced it would review the wood product standard. As a result, it is expected to announce new standards in the future.

#### *NIOSH Recommended Exposure Limit and New FEMA Procurement Specification*

The National Institute of Occupational Safety Institute (NIOSH) has a recommended formaldehyde exposure limit of 16 ppb. This NIOSH number is likely the basis for the limit FEMA has instituted for future purchases of temporary housing. This number is extremely low and likely impossible to meet. In fact, a recent study by a Swedish scientist suggests that on average human respiration contains formaldehyde sometimes in levels much higher than 16 ppb<sup>24</sup>. And as pointed out earlier, common household items and such activities such as cooking release levels of formaldehyde that in many instances would far exceed 16 ppb. School children often use glues containing formaldehyde levels in excess of this level. Therefore, FEMA's new standard may preclude travel trailers, park models and manufactured homes from being used in the future. Given CDC results that show "normal" formaldehyde background levels for site built-homes between 10 ppb and 30 ppb, it seems FEMA's new specification cannot be

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<sup>21</sup> 49 FR 31996, August 9, 1984

<sup>22</sup> Ibid

<sup>23</sup> Ibid

<sup>24</sup> Moser, Bodrogi, Eibl et.al/ Mass spectrometer profile of exhaled breath – filed study by PTR-MS, Respiratory Physiology & Neurobiology 145 (2005), pg 279. This study showed in 2.5% of the population had breath samples of 40 ppb.

met by any type of construction. In the event of another disaster on the scale of Hurricane Katrina, those who want to live on or very near their property may be forced to use only FEMA-supplied tents.

## **VI – The Travel Trailer Industry**

### *Industry Description*

Travel trailers are generally considered a subset of the broader category of recreational vehicles (RVs). A travel trailer is differentiated from other types of RVs by the fact it is towed by (but not mounted on) another vehicle. It can be detached from the tow vehicle, and this makes it more versatile. The recreational vehicle industry builds and ships roughly 300,000 units of all types each year in the United States. It has annual gross sales of \$14.5 billion.<sup>25</sup> Approximately 8 million households in the U.S. own a recreational vehicle.<sup>26</sup> The vast majority of trailer manufacturers are located in North-Central Indiana.

### *Industry Response to FEMA*

Only days after Hurricane Katrina devastated the Gulf Coast, members of the travel trailer industry entered contract negotiations with FEMA to supply units for the displaced population. The largest manufacturer, Gulf Stream, concluded its first agreement to supply 25,000 trailers on September 2, 2005, less than a week after Katrina struck.<sup>27</sup> Five days later Gulf Stream was issued another contract for 25,000 additional units, bringing FEMA's total order with Gulf Stream to 50,000.<sup>28</sup>

In order to fulfill contracts in a timely manner, Gulf Stream invested \$60 million of its own capital to prepare most of its production facilities to manufacture trailers for FEMA. In addition to converting existing lines, Gulf Stream also acquired new production facilities in order to accommodate FEMA's demands.<sup>29</sup> From an initial capability to produce 80 trailers per day, Gulf Stream was able to expand daily production to more than 300 trailers by November 2005. Other manufacturers did not expand operations to the same extent as Gulf Stream, but the capabilities of other companies were still strained in an effort to deliver the trailers as quickly as possible.<sup>30</sup>

For past disasters, FEMA had largely been able to satisfy its temporary housing needs by buying trailers from commercial retailers. However, the demand created by Hurricanes Katrina and Rita outpaced the ability of such establishments to meet FEMA's needs. FEMA purchased a certain amount of trailers from retailers, but also contracted

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<sup>25</sup> RVIA.org

<sup>26</sup> Ibid

<sup>27</sup> Manufacturer supplied documents - email

<sup>28</sup> Ibid

<sup>29</sup> Manufactured supplied documents – internal discussion points

<sup>30</sup> FEMA supplied charts on contracts quantities and numbers.

directly with manufacturers and brokers for the remaining need. A breakdown of the quantities and money spent for each can be found in Chart B.

**Chart B – Number of Trailers Purchased and Costs (Data Supplied by FEMA)**

	Number	Percent	Value	Percent
<b>Off the Lot</b>	<b>33,087</b>	<b>28%</b>	<b>\$ 676,387,132.69</b>	<b>37%</b>
<b>Direct Contract</b>	<b>76,800</b>	<b>64%</b>	<b>\$ 931,443,395.00</b>	<b>51%</b>
<b>Via GSA</b>	<b>10,145</b>	<b>8%</b>	<b>\$ 202,792,386.00</b>	<b>11%</b>
<b>Total</b>	<b>120,032</b>	<b>100%</b>	<b>\$ 1,810,622,913.69</b>	<b>100%</b>

For trailers bought directly from manufacturers, FEMA negotiated each contract individually. Given the magnitude of FEMA's trailer needs, it was able to extract significant price concessions. The price FEMA paid for trailers built specifically for this effort was much less than what would have been charged consumers who purchased a like unit "off the lot." In the case of Gulf Stream, FEMA paid approximately 50% of the normal retail price.<sup>31</sup> Additionally, FEMA did so using fixed cost contracts, meaning the price of each unit was set before production and delivery.<sup>32</sup>

There are no indications the trailers produced for FEMA were built significantly different from similar trailers on the retail market. In fact, internal manufacturer e-mails and company interviews indicate the trailers were built to the same specifications as the trailers supplied to FEMA in 2004 which received no formaldehyde complaints.

#### *Industry Suppliers and Manufacturer Testing<sup>33</sup>*

Firms which supplied trailer manufacturers with components and materials had to increase production as well, in order to allow manufacturers to fulfill FEMA's demands. This situation was exacerbated by the fact that trailer manufacturers shared many common suppliers. Historically, suppliers had assured the manufacturers that the wood

<sup>31</sup> The average retail price for a Gulf Stream trailer was \$18,221.

<sup>32</sup> The primary alternative to fixed cost contracting is cost plus contracting. In cost plus the government agrees to pay whatever the costs of production end up being, and bonuses based on the contractor's performance. This type of contracting is generally used for the procurement of non-existing products whose exact costs are unknown. As a well-established product line the cost of travel trailers is very predictable and therefore FEMA did not need to use cost plus contracts.

<sup>33</sup> The July 2008 hearing will undoubtedly discuss formaldehyde testing conducted by the manufacturers, either of component parts, during manufacturing process, or after the delivery of trailers. Because of an agreement reached with manufacturers, staff has agreed not to disclose actual testing data or the name of the manufacturers discussed below. The documents from which the data was derived were supplied under threat of a Committee subpoena. Because these documents may be covered by attorney work product privilege, firms agreed to provide the documents to the Committee on the condition the specific content was not disclosed. The minority staff will honor that request, until being released from this agreement or the documents are otherwise disclosed.

products delivered emitted low levels of formaldehyde. These claims were generally certified by third party inspectors in the U.S., but formal certificates were not issued.

One of the key components of travel trailers is "luan board." This is a type of plywood made from "Philippine mahogany," a wood which is similar in appearance to, but different from, "mahogany." Luan plywood is used because it is light weight and relatively inexpensive. It consists of wood chips and pieces which are glued together to form sheets. The adhesives used in some instances can emit formaldehyde. Luan board is only made in China and Southeast Asia, where the source wood grows.

The dramatic increase in demand for trailer components likely increased the pressure on the Asian suppliers, which may have been thus forced to seek materials from new sources. In this pursuit of more materials to fill orders, adherence to formaldehyde emission standards may have been largely overlooked; especially since no formaldehyde testing facilities exist in Asia. The travel trailer manufacturers, which relied on supplier claims regarding formaldehyde content, could have unwittingly accepted substandard product. Until the demand surge created by Hurricanes Katrina and Rita there had been no reason for supplier certifications to be questioned, because no prior formaldehyde complaints had been lodged.

From documents produced for the Committee, it is clear the manufacturers relied on the certifications of their suppliers that the wood products being provided for trailer construction emitted low levels of formaldehyde. During the peak manufacturing period (Spring and Summer 2006), it seems some manufacturers suspected that the components they were receiving may have had formaldehyde problems. However, documents show that suppliers were still indicating that they were delivering (or had delivered) only low-emitting components. One manufacturer had luan board independently tested in March 2006 on a desiccator. This test showed high levels of formaldehyde. However, according to CDC, desiccator tests are unreliable and the large chamber method is preferable.

Although it is not clear to what extent the company's senior management was aware of this effort, employees of one manufacturer also took the initiative and participated in testing trailers provided to FEMA. The effort involved using a "home test kit," and was highly unscientific. The employee had limited scientific training and admitted to not following the kit's directions. The results of the tests showed varying levels of formaldehyde but many of the readings were high, even compared to the HUD indoor ambient air target level.

The manufacturer was concerned about the results, and tried to share this data with FEMA. However, the Agency rejected the company's entreaty. Nonetheless, records show the manufacturer implored FEMA to allow it to work with the Agency to find answers to these questions, including the installation of more powerful vents to increase air circulation in potentially problematic trailers. FEMA rejected this approach

and all other attempts by the manufacturers to help FEMA identify and resolve possible problems<sup>34</sup>.

### *Supply and Mitigation Tests*

In 2008, FEMA arranged for tests to be conducted at the Lawrence Berkeley National Laboratory (LBNL) of specific materials typically used in four types of trailers bought by the Agency. These tests were undertaken to determine the specific sources and amounts of formaldehyde and other contaminants present in the components. Four trailers were disassembled in this process and 45 different samples were tested. *In a report released on May 8, 2008, the CDC announced 44 of the 45 samples taken from travel trailers were at or well below the HUD standard for wood products.*<sup>35</sup>

Despite testing which showed average levels of formaldehyde to be under the HUD standard, FEMA stopped issuing travel trailers for temporary housing. However, because occupants of existing units were not all capable of moving, FEMA requested CDC to identify and evaluate possible methods to reduce or eliminate formaldehyde concentrations in those units which remained occupied. Through an interagency agreement with the National Aeronautics and Space Administration (NASA), 15 travel trailers were set up at Stennis Space Center. Tests were conducted to evaluate 12 different methods to reduce the amount of airborne formaldehyde gas present. Although staff has been told the tests are completed, the results have not been made public.<sup>36</sup>

## **VII - Previous Committee Action**

The Committee on Oversight and Government Reform of the U.S. House of Representatives held a hearing on July 19, 2007 focusing on FEMA's management of its trailer inventory. Some questions were also raised about the Agency's response (or lack thereof) to reports of formaldehyde gas. Despite assertions to the contrary, it is now clear FEMA's actions were driven primarily by legal and public relations concerns rather than by an interest in the health of trailer occupants. The July 2007 hearing had no manufacturer witnesses.

## **VIII – Industry Performance**

According to documents supplied by FEMA, temporary homes for Hurricane Katrina and Rita victims were produced by 14 different manufacturers. Five of these firms (Gulf Stream, Forest River, Fleetwood, Keystone, and Pilgrim) accounted for 60%

<sup>34</sup> Manufacturer supplied documents show one manufacturer offered to install a powerful vent called the "fantastic vent" as a method to increase the amount of air exchange in FEMA trailers.

<sup>35</sup> Interim Report: VOC and Aldehyde Emissions in Four FEMA Temporary Housing Units, CDC and Lawrence Berkeley National Laboratory, May 8, 2008

<sup>36</sup> Reduction methods tested included ventilation, temperature/humidity control, plants, application of sealants, removal of off-gassing materials, and room air cleaners like photocatalytic oxidation.

of the total units of all types acquired by FEMA. The quantities and contract values for travel trailers can be found In Chart C.

<b>Chart C Travel Trailers Manufacturing and Production Contractors Purchased Directly</b>				
<b>Contract Number</b>	<b>Vendor</b>	<b>Type</b>	<b>Units</b>	<b>Amount</b>
<b>HSFEHQ-05-C-4000</b>	<b>Gulf Stream Coach</b>	<b>ADA</b>	<b>25,000</b>	<b>\$ 249,815,000</b>
<b>HSFEHQ-05-C-4039</b>	<b>Morgan</b>	<b>ADA</b>	<b>10,000</b>	<b>\$ 257,822,500</b>
<b>HSFEHQ-05-C-4039</b>	<b>Morgan</b>	<b>Regular</b>	<b>5,000</b>	<b>Included In Above Amount</b>
<b>HSFEHQ-05-C-4040</b>	<b>NACS (Forest River)</b>	<b>Regular</b>	<b>5,000</b>	<b>\$ 60,220,000.00</b>
<b>HSFEHQ-05-C-4041</b>	<b>Gulf Stream Coach</b>	<b>Regular</b>	<b>25,000</b>	<b>\$ 246,875,000.00</b>
<b>HSFEHQ-05-C-4126</b>	<b>Tom Raper RVs</b>	<b>Regular</b>	<b>800</b>	<b>\$ 18,610,895.00</b>
<b>HSFEHQ-05-C-4128</b>	<b>Bourgettes of the South</b>	<b>Regular</b>	<b>6,000</b>	<b>\$ 98,100,000.00</b>
<b>Grand Total</b>			<b>76,800</b>	<b>\$ 931,443,395.00</b>

Overall FEMA's procurement of trailers was haphazard. Some of the trailers FEMA bought from retailers were much older than those built specifically for the Agency.<sup>37</sup> Older trailers, especially those procured from a dealer lot, would have little to no noticeable formaldehyde problems because any gas would have dissipated in the course of being displayed for sale. In contrast, models procured directly from the factory floor would almost certainly have some formaldehyde because of the absence of any off-gassing period before being put to use.

FEMA has yet to provide the Committee's minority staff or the industry a database detailing each trailer's manufacturer and point of sale. This is significant because a full and complete assessment of the trailer testing requires an accurate and reliable database. There is anecdotal evidence to suggest FEMA's database is incomplete and contains errors that might be impossible to reconcile.

<sup>37</sup> A common practice in the industry is for the dealers to get sell the oldest models in their inventory first. If FEMA was looking for all available trailers and was willing to purchase them sight unseen then it is highly likely that at the least they got all the older models that were on dealer lots.



## IX – Litigation

Several products liability suits have been filed seeking damages from exposure to formaldehyde gas. The first of these was a class action suit filed on May 18, 2006 in the U.S. District Court for the Eastern District of Louisiana which serves New Orleans<sup>38</sup> The plaintiffs are:

[p]ersons residing in manufactured mobile home, mobile homes or travel trailers...along the Gulf Coast of the United States which, in turn, were provided by FEMA after the landfalls of Hurricane Katrina on August 25, 2005 through August 29, 2005, and who are being subjected to exposure to unlawful and harmful levels of formaldehyde while residing in FEMA housing.<sup>39</sup>

The defendants are the United States government, Gulf Stream Coach, Fleetwood Enterprises, (including a Canadian affiliate), Starcraft RV, Pilgrim International, Monaco Coach Corporation, KZRV, and various other FEMA vendors.<sup>40</sup>

The suit accuses the federal government of willful gross negligence.<sup>41</sup> Trailer manufacturers are similarly accused, and blamed for “breach of implied and express warranties.”<sup>42</sup> The plaintiffs seek both injunctive and monetary relief in the form of actual, consequential, punitive damages and attorney’s fees.

On October 24, 2007 this suit and several others filed elsewhere were transferred to the Eastern District of Louisiana.<sup>43</sup> In doing so, judicial officials found that:

All actions share factual questions relating to allegation that trailers – provided by the Federal Emergency Management Agency in the wake of Hurricanes Rita and Katrina – contain materials which emit dangerous, excessive level of formaldehyde. Centralization under Section 1407 will eliminate duplicative discovery; avoid inconsistent pretrial rulings, especially with respect to certification; and conserve the resources of the parties, their counsel, and the judiciary.<sup>44</sup>

The consolidated cases are referred to as “In re: FEMA Trailer Formaldehyde Products Liability Litigation.” As of June 10, 2008, U.S. District Judge Kurt D. Engelhardt was continuing to conduct status conferences and hear pretrial motions.<sup>45</sup>

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<sup>38</sup> Pls. Compl. at 1.

<sup>39</sup> Pls. Compl. at 3.

<sup>40</sup> Pls. Compl. at 2.

<sup>41</sup> Pls. Compl. at 17. It also appears that the plaintiffs have a pending federal tort claim.

<sup>42</sup> Pls. Compl. at 18-21. Certain causes of action as to certain defendants have subsequently been dismissed.

<sup>43</sup> Transfer Order of October 24, 2007 at 1.

<sup>44</sup> Transfer Order of October 24, 2007 at 1.

<sup>45</sup> Case Developments, updated June 17, 2008

<http://www.laed.uscourts.gov/FEMA07md1873/FEMAtailer.htm>

## **X – Conclusion**

It seems likely that at the July 2008 Oversight and Government Reform hearing, the majority will attempt to blame manufacturers for unsafe levels of formaldehyde in travel trailers sold to FEMA. This accusation will probably be based on the EPA/CDC reports on occupied and unoccupied trailers. However, while there is no dispute that these tests detected formaldehyde, the critical point in understanding the manufacturers' role is that the overwhelming majority of the trailers met the most applicable government standards for formaldehyde, and moreover, the government itself cannot agree on what is the proper standard and exposure limits.

In the immediate aftermath of Hurricane Katrina, a time of extreme crisis, FEMA decided that one way to house displaced people was in government-purchased travel trailers. For many, this was the most logical and reasonable solution. FEMA was under extreme pressure to procure, ship and set up trailers as fast as possible to allow hurricane victims to return to some sort of normalcy. That urgency was conveyed to the travel trailer industry, which responded quickly to FEMA's needs. Manufacturers, seeing an opportunity to do their part to help their fellow citizens, made trailers at a record pace and to the same specifications of retail units.

FEMA, manufacturers, and manufacturer suppliers were all under pressure. There is no real proof to demonstrate suppliers shipped only low-emitting formaldehyde components to the manufacturers, although data gleaned from manufacturers suggests this is the case. Moreover, government sponsored tests at Lawrence Berkley National Laboratory confirmed that the wood used in the construction was low emitting. This seems to disprove the contention advanced by others who speculated the source of the formaldehyde was substandard components.

Unfortunately for the manufacturers, public perception rather than science-based truth seems to be more important. The Sierra Club, trial bar, and Committee majority seem to imply that no amount of formaldehyde is "safe," despite the fact that in the great variety of recommended exposure limits, including the CARB standards being urged upon EPA by the Sierra Club, none establishes a zero exposure limit. Some in industry voluntarily followed the long-established HUD guideline, in good faith, in the absence of any mandated standard because of the similarities between RVs and the manufactured housing for which the standard was designed and because some manufacturers make both products and share some of the same suppliers.

In many ways, the industry is vindicated by government testing which showed the average levels of formaldehyde in occupied trailers were well below the HUD target

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level. In unoccupied trailers the numbers were similar after standard ventilation took place. Critics, however, want tighter standards.

The travel trailers provided to FEMA voluntarily met the only reasonable analogous government approved standards and target levels for indoor ambient air. Nevertheless, it seems that some intend to use the forthcoming hearing as a platform to argue for new federal regulations on indoor air quality. To this end, trailer manufacturers are a convenient scapegoat, and are now being asked – retroactively – to meet a moving target.

Whether the HUD standard should be amended is a question that, as this report notes, HUD is currently addressing. But it is unreasonable to hold manufacturers accountable for failing to meet a standard not yet in existence. Unfortunately, some in Congress and the administration seem to be willingly or unwillingly supporting this agenda. The result, if they succeed, will provide no benefit for public health but may cripple not only an important industry and major employer, but the nation's ability to respond quickly, effectively, and compassionately after the next inevitable disaster.